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The National Biological Monitoring Inventory[1,2]

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(Abstract)

The National Biological Monitoring Inventory, initiated in 1975, currently consists of four computerized data bases and voluminous manual files. MAIN BIOMON contains detailed information on 1,021 projects, while MINI BIOMON provides skeletal data for over 3,000 projects in the 50 states, Puerto Rico, the Virgin Islands, plus a few in Canada and Mexico. BIBLIO BIOMON and DIRECTORY BIOMON complete the computerized data bases.

The structure of the system provides for on-line search capabilities to generate details of agency sponsorship, indications of funding levels, taxonomic and geographic coverage, length of program life, managerial focus or emphasis, and condition of the data. Examples of each of these are discussed and illustrated, and potential use of the Inventory in a variety of situations is emphasized.

Introduction

There has been a long recognized need to identify the major monitoring programs in ecology. For many studies of environmental quality, time series data are vitally important. In some cases, the information already has been collected but is not readily available because it has not been published in traditional formats such as professional journals. Often the data are only available from the investigator. Frequently, the published data that do exist are years out of date. An important means of tracking these data is by awareness of the programs themselves. Ecological data are an essential constituent of environmental quality monitoring programs. However, the pollutant source and transport programs have received most of the attention from both scientists and regulatory agencies. Therefore, existing ecological monitoring programs must be inventoried before gaps in monitoring coverage, either geographic or taxonomic, can be corrected.

The National Inventory of Selected Biological Monitoring Programs was initiated in June 1975 to identify *current* or *recently completed* biological monitoring projects throughout the U.S. Key administrators were identified through a variety of environmental directories (AMA 1973, Clark 1974, CEQ 1973, EPA 1974, FAO/UN 1974, NAS 1974, Paulson 1974, SURC 1971, Thibeau 1972, TIE 1974, Trzyna 1973, Wilson 1974, and Wolff 1974). Principal investigators (PI's) were identified primarily by telephone calls to key administrators in all states and to natural resource agencies of local and federal governments. A total of about

In addition to a systematic set of code words, enhanced with additional keywords provided by the respondents, an abstract, geographical location, data status, statistical treatment, computerization, and availability of data were also requested for each project.

The primary objectives of the Inventory were:

1. To comprehensively identify and collect information throughout the U.S., including continental shelf waters, on biological monitoring projects.

2. To systematically organize the information in computerized files for on-line, interactive searching, for computer production of reports on technical subject categories, including organisms, study types, management focus, and geographical sites or regions, and to provide complete information retrieval and response/referral services.

3. To specifically identify and fully characterize those projects that document time trends of populations or communities of naturally-occurring flora and fauna.

The Inventory focused on projects that were monitoring natural biota and that were initiated to measure quantitative change through time. Specifically excluded from the biomonitoring inventory were projects concerned with human population attributes, agriculture, monoculture forestry, domestic animals, economics, ERTS and other remote sensing studies, and those in which *only* hydrological, meteorological, or physical-chemical water quality data were obtained. Obviously, these criteria also exclude many projects where living organisms are used as indicators of ambient environmental conditions. The Inventory has not

been concerned with "canary in the mine shaft" types of projects, nor with those where organisms are effectively used in lieu of physical instrumentation.

Information from the mailings was codified, categorized, computerized, and organized into several data bases. The main biological monitoring data base, accessible nationwide on DOE's RECON system, and supporting data bases are interrelated (Fig. 1). The directory data base (DIRECTORY) contains the names and addresses of approximately 7000 principal investigators to whom the documentation package was mailed. The MINI BIOMON data base briefly records all responses (more than 3100) to the Inventory. The bibliographic data base (BIBLIO) contains citations to published documents (about 2000) received with the responses. The main biomonitoring data base (MAIN BIOMON) contains over 1000 selected project responses judged to be most pertinent to the stated objective.

Procedures for developing the remaining data bases (taxa, geographic description, and tabular display) are established and these will be initiated as time and funds permit. Each will contain more complete project information in selected fields than is contained in the main biological monitoring data base. For example, the geographic description data base will contain a number of locational descriptor variations that will make it compatible with other geographically oriented systems. Additional effort will be required since much of the desired information is not contained in the responses received to date.

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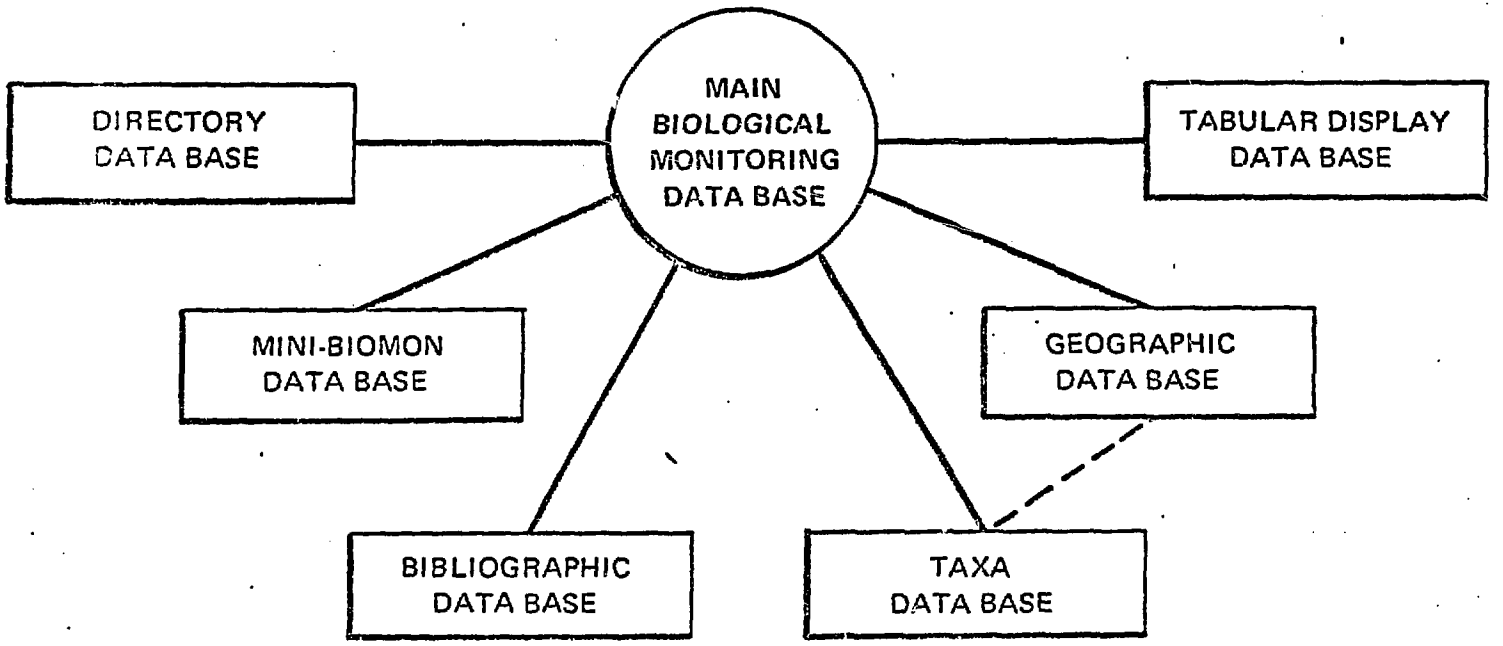
FIGURE 1. THE MAIN AND SUPPORTING BIOLOGICAL MONITORING DATA BASES



Results

At present, over 3000 responses to the biomonitoring inventory have been received from all states of the Union, some U.S. territories, Canada, Mexico, and several countries in the Carribbean (Fig. 2). These can be categorized in a number of ways. The numbers of projects in the MAIN data base that utilized the designated terms are summarized on the original documentation form (Fig. 3). By scanning, a general impression of levels of intensity of biomonitoring programs can be gained. For example, Item 18 (Fig. 3) indicates that 585 terrestrial, 452 freshwater, and 228 marine projects are currently in the inventory files.

An analysis of funding responses for all projects yields a conservative estimate of a total of $125 million per year. This figure is based on the median of the funding level information requested (<$10,000, $10-50,000, $50-100,000, >$100,000) and takes no cognizance of the many project responses which contained no funding information. The actual total must be considerably higher, but even an annual budget of $126 million is impressive and indicates the magnitude of the national effort in biomonitoring. The projects are sponsored by a diversity of state and federal agencies, teaching institutions, private concerns, and others (Table 1). The federal government leads in numbers of projects sponsored, while the private sector is poorly represented. While this may reflect an appropriate division of responsibilities, private groups are also the most difficult to identify and inventory.

The information received can also be characterized by sponsorship and taxonomic groups (Table 2). There are evident disparities between

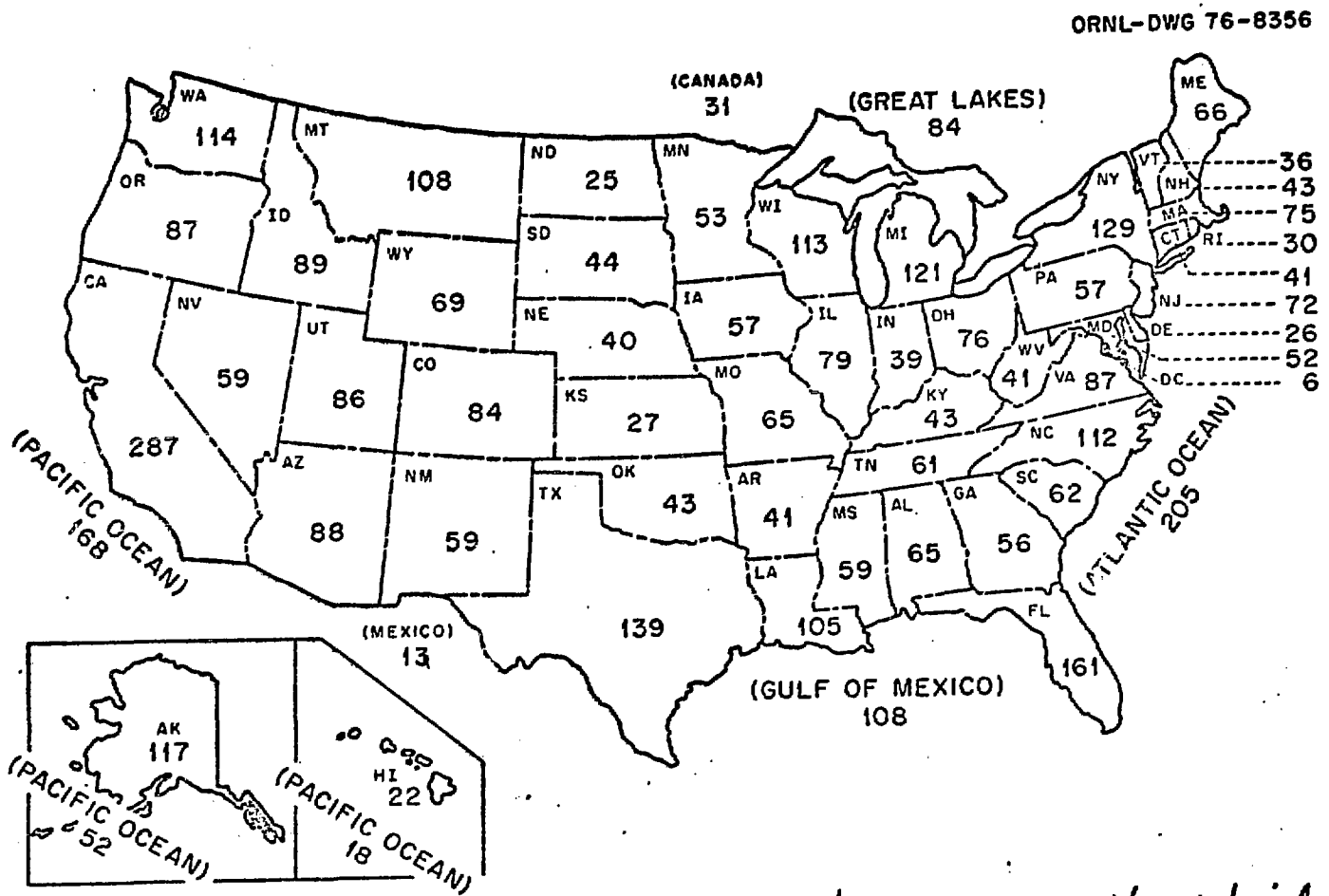


Fig. 2. Number of project responses, by state or region, in the National Biological Monitoring Inventory, as of May 1976.

Figure 3. Reproduction (reduced) of the Project Documentation Form with number of projects indicated for the various fields.

PRESIDENT'S COUNCIL ON ENVIRONMENTAL QUALITY

NATIONAL MARINE FISHERIES SERVICE

U. S. FISH AND WILDLIFE SERVICE

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

PROJECT DOCUMENTATION

NATIONAL INVENTORY OF BIOLOGICAL MONITORING PROGRAMS

PLEASE RETURN COMPLETED FORM TO:

BIOLOGICAL MONITORING INVENTORY
ENVIRONMENTAL SCIENCES DIVISION
OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE 37830

PHONE: (615) 483-8611
EXT. 3-0391

(Please print in black ink or type)

ADVISORY: THE INSTITUTE OF ECOLOGY

PRINCIPAL INVESTIGATOR

1. (NAME) (Last, First, Initials) Responses to the Inventory total 3192 with approximately the same number of investigators or co-investigators participating.

2. (BUSINESS ADDRESS)

3. (CITY) | 4. (STATE) | 5. (ZIP)

6. (INVESTIGATOR'S AFFILIATION)

7. (PHONE)
( ) Ext.

DESCRIPTION OF YOUR BIOLOGICAL MONITORING PROJECT

(If you are in charge of more than one project, please use additional enclosed forms as appropriate)

8. (PROJECT TITLE)

9. (PROJECT PURPOSE(S)) (Briefly)

Duration of Funding:

<1 year	43
1–5 years	418
>5 years	493
unknown	53

10. (PROJECT SPONSOR(S))

11. (SPONSOR'S PROJECT OFFICER)

12. (DATE OF INITIATION)

13. (ANNUAL PROJECT FUNDING) (Circle one, or fill in)
a. Exact Amount $ b. <$10,000 c. $10-50,000 d. $50-100,000 e. >$100,000
OTHER (Specify)

14. (WILL PROJECT BE CONTINUED?) (Circle one)
a. Yes b. No c. Unknown d. Terminated

15. (MAJOR OBSERVED CHANGE(S) IN TIME) [Briefly describe biotic change(s) identified as a result of your project]

16. (PROGRAM NAME) (If applicable)

17. (PROGRAM DIRECTOR OR ADMINISTRATOR) (If applicable)

18. (ECOSYSTEM OR BIOME TYPE) (Circle all applicable terms)

A. Terrestrial	585	3. savanna	54	B. Freshwater	452	C. Marine	228
1. desert	93	4. grassland	190	1. stream	224	1. coastal	197
2. forest	363	5. tundra	50	2. river	220	2. estuarine	149
a. coniferous	250	a. arctic	32	3. lake	221		
b. deciduous	228	b. alpine	27	4. reservoir	136		
c. tropical	17	6. wetland	131				

OTHER (Specify) 7. mountain 111 Aquatic studies total = 620

Will use shaded fig. for printing RLB

19. (LEVEL OF STUDY) (Circle all applicable terms)

A. organism	541
B. population	790
C. community	578
D. ecosystem	405
E. region	199

OTHER (Specify)

20. (MANAGEMENT FOCUS) (Circle all applicable terms)

A. endangered species	159	H. range	147
B. environmental impact	566	I. recreation	209
C. fisheries	298	J. resource planning	247
D. wildlife	344	K. pollution control	266
E. forestry	154	L. water quality	316
F. indicator species	367	M. power generation	112
G. radiological	36	N. right-of-way	27

OTHER (Specify)

21. (ORGANISM, MAJOR TYPE) (Circle all appropriate types)

A. Animals	826	2. invertebrate	381	B. Plants	361	C. Microorganisms	272
1. vertebrate	651	a. crustacea (specify order)	248	1. vascular	342	1. viruses	23
a. amphibia	64	_____		a. trees	210	2. bacteria	101
b. reptiles	58	b. insecta (specify order)	219	b. shrubs	215	3. fungi	54
c. fish	301	_____		c. herbs	258	4. algae	213
d. birds	236	c. other (specify phylum)		d. grasses	140	5. protozoa	58
e. mammals	252	d. mollusca	131	2. non-vascular (specify below)	50		
		e. shellfish	67	a. mosses	29		
		f. annelida	66	b. lichens	18		
				c. liverworts	3		

OTHER (Specify)

22. (TAXA) (Genus and species, other taxonomic names, or common names if few; or attach listing or publication, if numerous)

There are 832 projects with entries in this field. Of these, 622 contain Latin nomenclature as specified by responders with approximately 2600 genus, species, or other taxonomic names.

23. (KEYWORDS) (In addition to those under other headings. Limit to 10 words)

Approximately 1600 keywords are employed in addition to 132 "code words" employed in items 18, 19, 20, 21, 24, 25, 27, 33, and 34 of the questionnaire.

24. (PRIMARY PARAMETERS STUDIED) (Circle all appropriate types)

age	351	E. distribution	715	I. habitat characterization	493	M. kill	181	Q. numbers	656	V. sex	232
behavior	245	F. diversity	418	J. harvest	231	N. mortality	405	R. physiology	140	W. size/weight	270
biomass	323	G. emigration	179	K. home range size	156	O. migratory patterns	209	S. productivity (specify type)	216	X. stress	149
BOD	54	H. growth	385	L. immigration	165	P. natality	208	T. reproduction	356	Y. territory size	136
								U. residues	94	Z. toxicity	100

OTHER (Specify)

25. (SUPPORTING DATA COLLECTED) (Circle all appropriate types)

A. associated fauna	482	C. associated microorganisms	129	E. climatological data	363	G. soils	219	I. water quality data 379
B. associated flora	445	D. atmospheric chemistry	48	F. hydrological data	309	H. terrain	165	

OTHER (Specify)

26. (HOW WERE PRIMARY DATA COLLECTED?) (Use standard terminology, if possible)

27. (SAMPLING FREQUENCY)

A. continuous 135 B. seasonal 347 C. daily 90 D. weekly 182 E. monthly 260 F. quarterly 74 G. annual 246 H. other periodic 166 I. irregular 213

(NO. OF SAMPLING SITES)

No. or Other (Specify)

(GEOGRAPHIC DESCRIPTION) (Fill in all applicable descriptions, as known)

Region(s)		State(s)	
County(ies)	1054 names	Longitude	Latitude
River/stream name(s)	522		River mile(s)
Lake name(s)	263	Location other than county(ies)	
Power station name	95	Other industrial site name	

HER (Specify)

(GEOCODE UTILIZED) (Circle if applicable)

A. UTM B. FIPS C. geodetic (long/lat) D. grid/map overlay E. state plane

HER (Specify)

(PROJECT ABSTRACT) (300 words or less, or attach publication)

In Part B, 880 abstracts (86% of total projects) were provided by responders or adapted by NBIC staff from documents provided by responders. The total number of documents received and stored at NBIC was more than 2000 from the Inventory effort with 694 directly supporting projects contained in the MAIN BIO-MONITORING data base (PART B).

(OTHER PROJECTS, OPTIONAL) (Briefly identify important biomonitoring projects and investigators in your vicinity that are not directly associated with your project)

Project name

Investigator name and address

Project name

Investigator name and address

DESCRIPTION OF DATA RESULTING FROM YOUR PROJECT

(DATA TYPE) (Circle all applicable types you retain)

raw 798 B. reduced 534 C. summarized 785 D. literature-derived 296

THER (Specify)

(SUMMARY STATISTICS) (Circle all applicable terms)

A. mean	665	D. percentile	292	G. regression/correlation analysis	393	J. non-parametric analysis	126	M. modeling, stochastic	51
B. mode	141	E. analysis of variance	371	H. contingency table analysis	77	K. non-linear estimation	36	N. serial autocorrelations	21
C. median	178	F. analysis of covariance	109	I. multivariate analysis	164	L. modeling, deterministic	115		

THER (Specify)

35. (DATA COMPUTERIZED?) In Part B, 250 responders (24% of total) indicated data computerization along with computer type and/or language.

36. (DATA CODE NAME) (If applicable)

37. (COMPUTER TYPE)

38. (PROGRAM LANGUAGE)

39. (DATA AVAILABLE) (Circle applicable term)

A. unlimited distribution B. limited to Govt. contract use C. limited to authorized requesters D. not available E. available via publications only

OTHER (Specify)

40. (DATA AVAILABLE FROM?) (If same as investigator write "same")

Name Phone No.

Address

City State Zip Code

41. (COST OF DATA TO REQUESTOR) (Circle one)

A. yes B. no

42. (SPECIFY UNIT COST AND FORM OF DATA) (Briefly)

43. (PREFERENCE)

Would you prefer a summary of biological monitoring programs in your State? Region? U.S.? All three?

Or other? (Specify)

ADDITIONAL INFORMATION

COMMENTS OR REMARKS

Numbers of Federally Sponsored Projects by Agencies:

USDA	94	DOD	37	DOI	187	HEW	8
ARS	9	U.S. Army	3	USGS	5	ERDA	40
FS	74	COE	24	OWRT	23	EPA	46
SCS/CSRS	6	USN/ONR	7	BLM	7	SI	2
DOC	49	USAF	2	BR	8	TVA	6
NOAA	20			FWS	127	NSF	64
NMFS	28			NPS	22	NAS	2
BAFC	1						

NOTE: ANY COMMENTS, REMARKS, OR ADDITIONAL INFORMATION ARE WELCOME. PLEASE ATTACH AS DESIRED.

REMINDER: We would appreciate receiving any descriptive documents or reports about your project.

Table 1. Number of projects in categories of funding sponsors, based on responses to the inventory. Approximately 9 percent of the projects have multiple sponsors.

Category	Numbers of Projects
Federal Government	1557
State Governments	776
Teaching Institutions	491
Private Concerns	269
Societies, etc.	74
Not Funded	482

TABLE 2. Numbers of biomonitoring projects in each state, categorized by funding source and sorted on codewords for four major taxonomic groups. Totals are meaningless, as many projects have joint sponsorship as well as overlap in subject matter and geographical coverage (e.g., a single project may cover both birds and mammals in parts of Montana and Wyoming).

STATE	TOTAL NO. OF STUDIES	NO. OF STUDIES FEDERALLY FUNDED	NO. OF STUDIES STATE FUNDED	NO. OF BIRD STUDIES	NO. OF MAMMAL STUDIES	NO. OF FISH STUDIES	NO. OF PLANT STUDIES
Alabama	66	40	15	1	3	6	4
Arkansas	125	79	47	5	22	20	13
Arizona	88	57	21	3	6	7	6
Arkansas	40	23	11	0	0	5	4
California	291	152	43	4	6	30	5
Colorado	84	43	23	4	5	8	8
Connecticut	40	20	10	0	0	5	2
Delaware	27	16	1	0	0	1	0
Florida	162	80	27	3	1	12	10
Georgia	57	32	11	0	1	2	3
Hawaii	16	2	0	0	0	0	0
Idaho	90	51	27	0	6	8	5
Illinois	80	25	28	9	4	8	5
Indiana	38	17	5	1	1	2	3
Iowa	57	18	24	4	3	14	3
Kansas	28	10	8	2	3	6	11

TABLE 2. (Cont.)

STATE	TOTAL NO. OF STUDIES	NO. OF STUDIES FEDERALLY FUNDED	NO. OF STUDIES STATE FUNDED	NO. OF BIRD STUDIES	NO. OF MAMMAL STUDIES	NO. OF FISH STUDIES	NO. OF PLANT STUDIES
Kentucky	44	18	4	0	0	1	1
Louisiana	103	54	20	2	2	12	2
Maine	67	39	25	2	2	11	7
Maryland	57	36	18	6	4	12	2
Massachusetts	75	37	9	0	0	5	2
Michigan	122	64	26	8	3	13	4
Minnesota	54	34	6	0	1	2	3
Mississippi	60	38	10	2	2	6	2
Missouri	65	32	11	0	0	2	3
Montana	109	67	37	9	14	12	7
Nebraska	40	19	11	5	2	3	0
Nevada	59	37	7	0	2	2	1
New Hampshire	47	25	13	2	1	1	1
New Jersey	73	36	12	4	3	4	3
New Mexico	60	40	9	1	1	1	3
New York	130	56	16	1	0	14	2
North Carolina	112	56	17	1	0	8	6
North Dakota	26	15	9	2	1	2	2

TABLE 2. (Cont.)

STATE	TOTAL NO. OF STUDIES	NO. OF STUDIES FEDERALLY FUNDED	NO. OF STUDIES STATE FUNDED	NO. OF BIRD STUDIES	NO. OF MAMMAL STUDIES	NO. OF FISH STUDIES	NO. OF PLANT STUDIES
Ohio	78	32	9	2	2	6	4
Oklahoma	43	23	10	0	0	6	1
Oregon	92	63	11	1	3	6	4
Pennsylvania	59	26	8	2	2	3	1
Rhode Island	31	18	6	1	0	4	2
South Carolina	63	33	9	0	0	5	3
South Dakota	45	29	12	8	4	0	2
Tennessee	61	37	7	2	2	2	2
Texas	143	66	30	11	10	13	11
Utah	86	52	28	6	12	7	10
Vermont	38	24	15	0	7	3	3
Virginia	86	40	11	3	2	4	5
Washington	120	66	25	10	10	7	8
West Virginia	42	22	10	6	4	2	2
Wisconsin	117	43	40	9	5	17	10
Wyoming	70	36	32	9	12	15	8

federal- and state level projects, and it appears that different groups of organisms received more attention in some places than in others. This type of tabular analysis does permit gaps in monitoring coverage to be identified, however, and adequate planning can then be extended to cover agency programs, dollar investment, regional issues, energy technologies, and a variety of potential environmental impacts.

A matrix summary shows the flexibility with which the information can be manipulated and organized, with an example of Atlantic Coast wetland studies (Table 3). This analysis reflects great interest in endangered and indicator species and in water quality. The degree of interest in power/energy and resource planning also appears to be high.

The matrix format used in Table 3 can help to make judgments regarding the adequacy of biological monitoring coverage throughout the U.S. Care must be exercised in making interpretations of this type, however, due to limitations imposed by our definitions and to the degree of coverage achieved. The matrix can be enlarged to dozens of subject categories along each axis, but this is impractical for tabular display. The computer can be used to prepare alternate matrices that may be required for individual states or for regions that can be defined by state boundaries. Further refinement of geographic descriptions (longitude/latitude; county name or FIPS code, etc.) will allow more precise summaries.

Summarized information has been provided to all of the initial sponsors (Council on Environmental Quality, Department of Energy, Fish & Wildlife Service, and National Marine Fisheries Service) and also to

Table 3. Number of monitoring program responses for Atlantic Coastal Wetlands (126 total), arranged by subject and management focus. Numbers in columns are not additive as projects were characterized by multiple use of keywords and codewords.

Management Focus	Subject Category					
	Regional	Site Specific	Plants	Animals	Microorganisms	Fisheries
Endangered Species	3	15	9	16	3	8
Environmental Impact	12	48	28	42	23	22
Indicator Species	9	24	12	27	17	15
Power/Energy	8	15	8	18	15	10
Coal	0	0	0	0	0	0
Oil	0	2	0	1	2	0
Nuclear	3	2	2	4	5	2
Right-of-Way	3	3	5	6	3	3
Other	2	8	6	7	3	3
Resource planning	6	27	22	26	12	11
Water Quality	7	26	21	24	21	17
Total	(17)	(109)	(71)	(87)	(36)	(30)

stet

several offices and laboratories of the Environmental Protection Agency, the Corps of Engineers, the U.S. Geological Survey, the National Oceanographic and Atmospheric Administration, the National Park Service, the Nuclear Regulatory Commission, and the National Science Foundation. Exchange of information continues with these and other organizations such as the Arctic Environmental Information and Data Center, Texas System of Natural Laboratories, the Nature Conservancy, Oceanographic Institute of Washington, Cornell University Bird Observatory, Battelle-Columbus Laboratory, and the National Focal Point for the United Nations Environmental Program, International Referral System.

A series of reports has been published and additional documents are planned. Initially, a study of biological trends indicative of environmental quality changes (Suffern, et al. 1976) was prepared from projects identified through the Inventory. This was an attempt to provide information relevant to CEQ's annual report. The MAIN data base (Kemp 1977) contains full descriptions of 1,021 selected projects. More recently, the procedures used to construct the questionnaire have been documented (Kemp et al. 1978), illustrating how careful preparation and attention to human psychology can result in higher response levels.

Selected topics on regional or energy-related themes will be addressed in subsequent documents. Projects will be summarized, data analyzed, and interpretive recommendations will be made concerning the status of biological monitoring in these areas of interest.

Summary

The National Inventory of Selected Biological Monitoring Programs presents a source of information for those involved in planning and conducting environmental impact studies, in ecological and ecosystem research, and in all aspects of resource management. Searches of computerized data bases can provide extensive information summaries on individual states or selected regions and a wide variety of technologies. The degree and diversity of responses to the Inventory indicate the need for it and its probable future utility. The ability to derive more fully refined information from both the main and supporting data bases will improve as these are developed and supplemented with further information.

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Report of the Workshop on Communication and Dissemination of Information

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The Charge

This session had to come to grips with the national needs for communication among monitoring programs, scientists, and managers; the relation of these to Federal (and state) agencies, missions, and programs; the impact of existing (and proposed) legislation at national, regional, state, and local levels; and the information prerequisites for transfer to policy and decision authority.

The workshop had to consider, discuss, and make recommendations on:

1) The need for an information center (or centers) with computer capabilities to inventory, abstract, and otherwise document biological monitoring research, legislation, facilities, scientists, litigation, and user groups.
2) The need for a society (or other official or quasi-official forum) for scientists engaged in biological monitoring activities, to promote and provide a vehicle to discuss problems, progress, technology, and needs.
3) The need for a national (or regional) technical publication.
4) The need to continually devise and implement ways to provide information to the public sector.

The Results and Recommendations

The working group considered a series of items connected with the general problem of communication and information dissemination. We discussed the potentials for both a single information center or a series of these, and the recommendation was put forth rather strongly that a single center was required to manage inventory collation, aggregation of data and information, analysis of results and the ultimate dissemination. This was followed (again rather strongly) by an implication or recommendation that the effort that has been going on at Oak Ridge National Laboratory for the past three years be continued. The National Biomonitoring Inventory needs to be updated, expanded, and attempts made to serve a relatively broad user group.

A second topic addressed was the need for a society or some kind of an organization that could give some semblance of officiality to the various groups and individuals interested in all of the facets of biological monitoring. This discussion considered a spectrum of interests, ranging from the general public to scientific groups to the regulatory people, and including managers and decision-makers at all levels. There are a few possibilities here, and we came to no single, firm conclusion. Hence, it becomes a problem for the larger group of conference participants. First of all, we can consider the formation of some kind of a society which could serve the various needs that we recognize. As an alternative, a group or committee could spend the next few months considering and investigating the possibilities of forming some type of consortium from existing organizations. Committees, sections, or

subgroups within the various societies that are represented in this conference should be able to surface a commonality under which we can begin to operate in a biological monitoring context. Many groups were mentioned, including various microbiological societies, ecological societies, chemical societies, soil societies and so on. We ask that all participants, working within professional societies, attempt to identify a committee or some kind of a working group within this suite of societies. Over the next several months it may be possible to elicit some interest in a group of societies, convene a meeting of representatives, and determine whether or not such a consortium might come to fruition.

The third item discussed was the need for a national (or other scope) publication. The consensus was strongly positive, but the general nature of such a publication needs further exploration. We considered the possibilities of creating and producing a general periodical document, perhaps a newsletter, that would address primarily the public groups. We talked about scientific journals and how they might fit into the total scheme. Again we drew on the fact that the biological monitoring group represented at this conference is in fact representative of a rather broad array of societies, all of whom tend to have journals, newsletters, or bulletins of their own and we examined the possibilities of incorporating information (such as short articles on the results of this workshop) in these existing outlets. Some exploration of these various existing organs will be done by some of the workshop participants.

Finally, there was a fourth category that in part built on the experiences that we have all had over the past couple of days. We

identified the need to make these kinds of biomonitoring information and activities more generally available to the public, including, of course, the kinds of exchanges experienced at the meeting. The consensus of the working group and the recommendation was that we investigate the possibilities of stimulating regional biological monitoring meetings of a general nature in other parts of the country. Perhaps in twelve to eighteen months, a national meeting could be arranged following this series of regional workshops. A national conference could emphasize and view from different perspectives many of the problems that we have addressed here.

Other aspects of public information, of course, include the already stated need for certain kinds of publications that would interpret the need and the nature of biological monitoring for a wider public group, and the need for public relations activities. It is evident from the past two days that biological monitoring has arrived. It is something that is going to burgeon over the next few years, based largely on national and international needs, and we must devise ways to elicit full public support, which, of course, many times can be translated into government action. The user-public, however that group may be identified, needs to be specifically and explicitly invited to future biological monitoring meetings and conferences. In planning and implementing this workshop, Doug Worf and colleagues have done an amazing job, but there were some in the working group who felt that there was a significant segment of the population, the interested public, that could well have profited from this experience.

In summary, we recommend a very active approach to a broad group of users and potential users, and interested individuals and agencies, rather than the somewhat more passive approach of putting out a notice to see who may be interested.